

**A NEW NEOTROPICAL SPECIES OF *ANTHONOMUS*
(COLEOPTERA: CURCULIONIDAE) ASSOCIATED WITH
BOMBACOPSIS QUINATA (BOMBACACEAE)**

WAYNE E. CLARK AND HORACE R. BURKE

(WEC) Alabama Agricultural Experiment Station, Department of Zoology-Entomology, Auburn University, Alabama 36849; (HRB) Department of Entomology, Texas A&M University, College Station, Texas 77843.

Abstract.—Larvae, pupae, and adults of *Anthonomus santarosae* Clark, a new species of Anthonominae from Costa Rica, Panama, and Venezuela, are described and illustrated. Larvae develop in aborted flower buds of *Bombacopsis quinata* (Jacq.) Dugand in Costa Rica. Characters of all three stages are compared with those of *A. grandis* Boheman, species in the *Anthonomus* subgenus *Anthonomorphus* Dietz, and anthonomines of the genera *Loncophorus* Chevrolat and *Atractomerus* Duponchel and Chevrolat.

The new anthonomine weevil described here is represented by adults, larvae and pupae from Costa Rica, and by adults from Panama and Venezuela. The specimens from Costa Rica were reared or extracted from aborted flower buds of *Bombacopsis quinata* (Jacq.) Dugand, a common tree in the Santa Rosa National Park in Guanacaste Province, Costa Rica (Janzen, 1983). The species is described now to make a name available for ecological studies being conducted by Dr. Janzen. It is of particular interest because it is among those Anthonominae currently being examined in an attempt to elucidate the phylogenetic relationships of the boll weevil, *Anthonomus grandis* Boheman. Adults, larvae, and pupae are described and compared with the corresponding stages of *A. grandis* and related anthonomines.

***Anthonomus santarosae* Clark, NEW SPECIES**

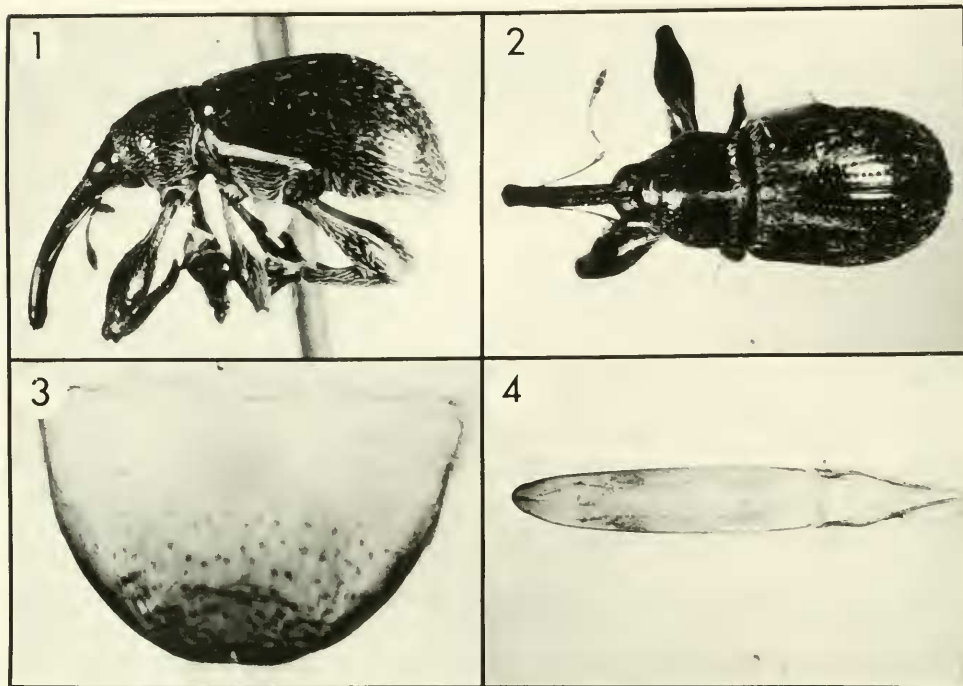
Holotype.—♂, COSTA RICA, labelled [83-SRNP.37], and [Santa Rosa National Park/Guanacaste Province/Costa Rica, D. H. Janzen]; deposited in the United States National Museum of Natural History, Washington, D.C.

Paratypes.—3 ♂, 7 ♀, with same label data as holotype; 84 ♂, 149 ♀, labelled [COSTA RICA: Guana./Santa Rosa Nat. Park/13-14 February 1984/D. H. Janzen, 300 m], and [reared from aborted/fallen flower buds/*Bombacopsis quinatum*/em. 20-29 Feb. 1984]; 1 ♂ [CANAL ZONE, Barro/Colorado Is., UV/trap 1 (3 m high)/21 Mar 1977 H. Wolda]; 2 ♂ [CANAL ZONE, Barro/Colorado Is., UV/trap 3 (26 m high)/(28 Dec 1978, 6 Mar 1979) H. Wolda]; 5 ♂, 4 ♀ [PANAMA, Pan./Las Cumbres/H. Wolda, malaise/trap, January 1982]; 1 ♂, 1 ♀, labelled [Venezuela-Bari-/nas. Reserva Fo-/restal-Ticopero./280 m 3-10-IV-66], [F. Fernandez Y./Luis J. Joly.], and [Venezuela-Inst./Zool. Agricola/Fac. Agronomia/Univ. Cen-

tral]. Total paratypes, 257; deposited in the collections of the National Museum of Natural History, Washington, D.C.; Auburn University, Auburn, Ala.; Texas A&M University, College Station, Tex.; La Universidad Central de Venezuela, Maracay; and in the collection of C. W. O'Brien, Florida A&M University, Tallahassee, Fla.

Larvae and pupae.—Eight 3rd instar larvae removed from flower buds of *Bombacopsis quinata* gathered Feb. 1, 1984, in Santa Rosa National Park, Guanacaste Province, Costa Rica, by D. H. Janzen; eight pupae extracted from flower buds of *Bombacopsis quinata* gathered Feb. 1, 1984, in Santa Rosa National Park, Guanacaste Province, Costa Rica, by D. H. Janzen; identified by association with adults in buds; deposited in the Insect Collection, Department of Entomology, Texas A&M University. Larvae and pupae are not considered to be paratypes.

Adult male (Figs. 1–4).—**Length:** 3.9–4.9 ($m = 4.6$, $n = 15$) mm. **Width:** 1.7–2.0 ($m = 1.98$, $n = 15$) mm. **Head:** Vertex sparsely, minutely punctate; each puncture with a narrow, whitish, setiform scale; venter with slightly broader, non-imbricated white scales; eyes round, evenly convex, separated by distance ca. equal to $0.5 \times$ width of rostrum at base. **Rostrum:** Length 1.6–1.8 ($m = 1.64$, $n = 15$) \times pronotal length; evenly curved from base to apex; in dorsal view, sides subparallel to antennal insertions, slightly constricted between there and apex; portion distal to antennal insertions 28–34 ($m = 31$, $r = 15$) % of total rostral length; proximal portion carinate, with shallow dorsolateral sulcus and deeper, punctate, lateral sulcus; with sparse, setiform white scales; antennal funiculus 7-articulate, article 1 about as long as articles 2–6 combined. **Prothorax:** In dorsal view (Fig. 2), sides rounded behind subapical constriction, abruptly widened at extreme base; in profile (Fig. 1), slightly, evenly convex; pleuron with dorsal, posterolateral excavation above lateral prominence and deep, posterior, submarginal sulcus; punctation dense on dorsal midline, sparse laterally, slightly more dense on pleuron; each puncture with an elongate, acuminate white to aeneous scale; interspaces broad, smooth, shining; scales on pleuron not different from those on lateral portions of dorsum. **Elytra (Figs. 1, 2):** Humeri slightly prominent, sides broadly constricted in basal $\frac{1}{2}$, widened in posterior $\frac{1}{2}$; interspaces 1–3 flat, widened slightly posteriorly, not depressed at extreme base, separated by narrow, deep, punctate striae; interspace 4 depressed at extreme base, narrowed posteriorly to basal $\frac{1}{4}$, slightly curved and distinctly widened posteriorly; interspace 5 depressed at extreme base, abruptly inflated and strongly curved in basal $\frac{1}{4}$; interspaces 6–10 more nearly uniform in width and convexity, striae separating them shallower, more sparsely punctate; surface of interspaces 1–3 distinctly punctate on disc; these interspaces posteriorly, and other interspaces throughout, not obviously punctate; vestiture consists of elongate, narrow, recumbent, whitish to aenescent scales; vestiture dense on extreme base of interspaces 1 and 2, and on basal $\frac{1}{4}$ of interspace 3, sparse on more convex portions of other interspaces, slightly more dense posteriorly. **Pygidium (Fig. 3):** Convex, evenly rounded apically; with small apicodorsal emargination; exposed portion punctate, with elongate, acuminate scales. **Abdomen:** Sterna 1–5 subequal in length, flattened medially, with sparse, narrow setae medially, broader, acuminate, whitish scales laterally; posterior margin of sternum 5 unmodified. **Genitalia (Fig. 4):** Median lobe with sides subparallel, narrowed apically; endophallus bearing scattered denticles. **Legs:** Profemur about $1.4 \times$ broader than metafemur; distal tooth of pro-



Figs. 1-4. Adult male, *A. santarosae*, Santa Rosa National Park, Guanacaste Province, Costa Rica. 1, Habitus, lateral view. 2, Habitus, dorsal view. 3, Pygidium, dorsal view. 4, Median lobe of genitalia, dorsal view.

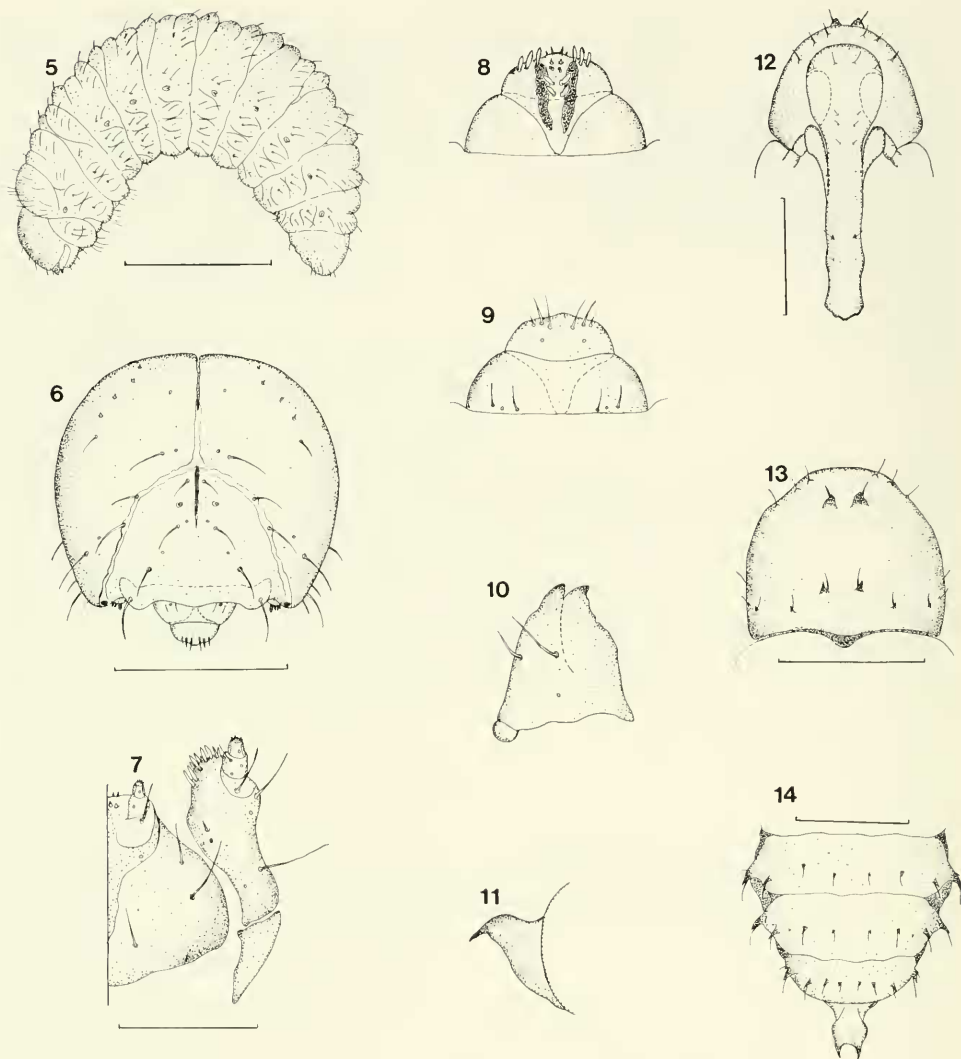
femur with serrate distal margin; protibia straight on dorsal margin, ventral margin with strong, obtuse, median, subapically subangulate prominence; apical mucro long, slender; metatibia with broader, longer, less abrupt median prominence on ventral margin, constricted and narrowed at apex; apical mucro short, curved, excavated.

Adult female.—*Length*: 3.7–5.2 ($m = 4.8$, $n = 15$) mm. *Width*: 1.7–2.6 ($m = 2.0$, $n = 15$) mm. *Rostrum*: Length 1.7–1.9 ($m = 1.85$, $n = 15$) \times pronotal length, broadly, evenly curved from base to apex; portion distal to antennal insertions 36–41 ($m = 39$, $n = 15$) % of total rostral length. *Pygidium*: With subangulate apicomedian prominence. *Abdomen*: Sternum 5 narrowed and slightly prominent apicomediaally.

Larva (Figs. 5–10).—The following description is based on third instar larva. Terminology is that of Anderson (1947). *Body* (Fig. 5): Strongly curved; length ca. 4.5 mm. Asperities minute, tubercle-like, irregularly distributed on dorsal and ventral areas of body. Color white, except for reddish brown area on pronotum. *Head* (Fig. 6): Pale amber; width of head capsule 0.85–1.07 mm ($n = 8$). Basal article of antenna bearing subconical accessory appendage and four stout setae, one of which is slightly longer than others. Endocarina distinct, ca. $\frac{1}{2}$ length of frons. Epicranial suture less than $\frac{1}{2}$ length of head capsule. Four pairs of frontal setae present; seta 1 about $\frac{2}{3}$ length of seta 3; frontal setae 3, 4 and 5 long, slender, of about equal length. Two pairs of frontal sensilla, one pair located mesad of bases of frontal setae 3, another located ca. $\frac{1}{2}$ way between bases of setae 3 and

4. Five pairs of dorsal epicranial setae present; setae 1, 4 and 5 slender, nearly equal in length; setae 2 and 3 shorter than other dorsal epicranial setae, 2 slightly shorter than 3; setae 3 and 4 located either in or adjacent to frontal suture. Four pairs of short peg-like postcranial setae arranged in a slight arc, with lowermost located directly above dorsal epicranial seta 2. Three pairs of epicranial sensilla; one pair located $\frac{1}{2}$ way between postepicranial seta 3 and epicranial suture; one pair mesad of epicranial seta 1; third pair between epicranial setae 4 and 5. Lateral epicranial seta 1 about $\frac{2}{3}$ length of 2. Ventral epicranial setae 1 and 2 ca. equal in length. Clypeal setae (Fig. 9) slender; seta 1 slightly longer than 2; seta 2 located farther from anterior margin of frons than 1. One pair of clypeal sensilla; each member of pair located adjacent to anterior margin of frons, halfway between bases of setae 1 and 2. Three pairs of labral setae (Fig. 9); setae 1 and 2 ca. the same length but 2 stouter; seta 3 much shorter. Epipharynx (Fig. 8) bearing two pairs of anteromedian setae, innermost pair longer. Three pairs of stout anterolateral setae present. Labral rods stout, converging slightly posteriorly. Two groups of epipharyngeal sensory pores consisting of two pores in each group. Two pairs of short, stout epipharyngeal median spines present between labral rods. Mandibles (Fig. 10) with two teeth; bearing two long, slender setae of ca. same length. Maxillary palps with apical article (Fig. 7) nearly $\frac{2}{3}$ length of basal article, bearing several small elongate tubercles at apex; basal article with seta the length of which is ca. $\frac{2}{3}$ width of article. Stipital setae, 1, 3 and 4 long, slender, seta 1 longer than other two; seta 2 considerably shorter. Mala bearing 11 stout setae, 6 ventral and 5 dorsal. Labial palpus consists of two articles. Premental sclerite with long, stout posterior process. One pair of long, slender premental setae. Four pairs of glossal setae, two pairs short, stout, other two pairs slightly longer. Postmental setae long, slender; seta 3 shorter. *Thorax* (Fig. 5) (setae described on one side of the body only): Pronotum bearing 10 long setae and one short seta. Prodorsal seta long, slender. Five postdorsal setae present; setae 1, 3 and 5 distinctly longer than 2 and 4. Three spiracular setae present, two of which are of equal length and longer than the third. Epipleural lobe bearing one long seta. Two long prothoracic pleural setae; one pleural seta on each of meso- and metathorax. Four long pedal setae. Sternal seta about $\frac{2}{3}$ length of pedal setae. *Abdomen* (Fig. 5): First seven abdominal segments bearing three dorsal folds; segment VIII with two well-defined folds. Prodorsum of each segment bearing a moderately long seta. Five postdorsal setae present; setae 1, 3 and 5 much longer than 2 and 4. Two spiracular setae; seta 2 at least $3\times$ longer than 1. Epipleurum bearing one long seta and another ca. $\frac{1}{2}$ as long. One moderately long pleural seta and an equally long pedal seta. Two short, inconspicuous pedal setae on each segment. Anus subterminal, surrounded by four lobes; one long ventral seta in area of anterior lobe; other lobes apparently without setae. Elsewhere on segment IX two short setae present dorsally near anterior margin of segment; seven setae laterally near apex of segment. Spiracles bicameral, air tubes with 5 or 6 annuli.

Pupa (Figs. 11–14).—Terminology of pupal characters follows Burke (1968). *Body*: Length 4.9–6.0 mm ($n = 8$). *Head* (Fig. 12): Supraorbital setae fine, straight to slightly curved or strongly bent near apices, each ca. $\frac{2}{3}$ length of frontal seta; borne on supraorbital ridge. Frontal setae stout, straight; each borne on summit of low tubercle; tubercles separated by distance equal to slightly more than length of a seta. *Rostrum* (Fig. 12): Extending to apices of tarsi of mesothoracic legs in



Figs. 5-14. Larva and pupa of *A. santarosae*. 5, Larva, lateral view. 6, Larva, frontal view of head capsule. 7, Larva, ventral view of labium and left maxilla. 8, Larva, epipharynx. 9, Larva, clypeus and labrum, dorsal view. 10, Larva, mandible. 11, Pupa, lateral view of abdominal segment IX. 12, Pupa, head, rostrum and ventral view of prothorax. 13, Pupa, prothorax, dorsal view. 14, Pupa, terminal abdominal segments, dorsal view. Line accompanying Fig. 5 = 2 mm; Fig. 6 = 0.5 mm; Fig. 7 = 0.25 mm; Figs. 8, 9, 10, 11 = greatly enlarged; Fig. 12 = 1 mm; Fig. 13 = 1 mm; Fig. 14 = 1 mm.

male, slightly past these in female. One pair of straight distirostral setae; each seta borne subapically on small, pointed tubercle; length of each seta equal to ca. $\frac{1}{5}$ width of rostrum. An additional pair of shorter setae located distad of distirostrals; each seta borne on minute, acutely pointed tubercle. Three pairs of fine, straight to slightly curved basirostral setae, proximal pair somewhat stouter; not borne on tubercles or borne on minute ones; sometimes irregularly spaced so that they do not appear to be paired. *Prothorax* (Fig. 13): Prothoracic depression absent. Pronotal setae usually straight, sometimes feebly curved; setae on anterior margin

of pronotum stouter than posterior ones. Anteromedian setae each borne subapically on anterior face of large, obtusely pointed to broadly rounded tubercle; length of each seta equal to slightly more than height of tubercle. Tubercles separated by distance equal to ca. width of a tubercle. Three pairs of anterolateral setae, each of which is borne on summit of low, flat-topped tubercle; tubercle 2 usually located slightly closer to tubercle 1 than to 3. Posteromedian setae each borne near base of sharply pointed tubercle; tubercles separated by distance equal to about $2\times$ height of tubercle. Four pairs of posterolateral setae, each of which is borne at or near base of sharply pointed tubercle; tubercles decreasing in size laterally, outermost sometimes rounded dorsally. *Mesonotum*: With three pairs of straight mesonotal setae; two inner setae, each borne at base of large sharply pointed tubercle; outer seta higher on summit of slightly rounded tubercle or at base of a small sharply pointed one. Anteronotal setae absent. *Metanotum*: Bearing three pairs of usually straight setae, each of which is borne at base of sharply pointed tubercle; about equally separated from each other. *Abdomen* (Fig. 14): With three pairs of discotergal setae which increase in length laterally; discotergal seta 1 on terga I–IV or V borne on summit of low, rounded tubercle, on remaining terga located at base of small, sharply pointed tubercle; discotergals 2 and 3 borne at bases of sharply pointed tubercles (except occasionally discotergal 1 sessile on tergum I) that increase gradually in size posteriorly. Laterotergal setae 1 and 2 present on each of terga I–VIII; seta 1 minute, borne at base of small sharply pointed tubercle on all terga; seta 2 borne subapically on sharply pointed tubercle on terga I–VIII, tubercles increase gradually in size posteriorly. Anteronotal setae absent. Spiracles present on abdominal segments I–VI, well developed on I–V, poorly developed on VI. One pair of laterosternal setae on each segment located directly below laterotergal seta 2; length of seta ca. $\frac{1}{4}$ length of laterotergal seta 2. Sub-laterosternal setae absent. Segment IX bearing a pair of sharply pointed posterior processes (Fig. 11), which in side view point slightly to strongly downward; setae absent on segment.

DISCUSSION

The paratypes from Panama differ from the Costa Rican and Venezuelan specimens in being slightly more robust and darker. The Panamanian specimens are black and shining, but the Costa Rican and Venezuelan ones are brownish (many of them are teneral). The specimens from Panama also have shallower punctures and sulci and slightly less dense vestiture on the prothorax and elytra.

Adults of *A. santarosae* may be distinguished from all other known *Anthonomini* by the distinctive shape of the elytra (Fig. 2), which are enlarged posteriorly, and by the 4th elytral interspace being narrowed at its base and widened and curved posteriorly. The 4th elytral interspace also has a dense vestiture of elongate scales in its basal $\frac{1}{3}$. Also distinctive is the metatibia of the male, which has a median prominence on the ventral margin and is constricted and narrowed at the apex. In addition, *A. santarosae* differs from the related *A. grandis* by its narrower form, larger eyes in comparison to the head, and more strongly sinuate inner margins of the male tibiae. These differences also distinguish *A. santarosae* from species of the subgenus *Anthonomorphus*.

The larva of *A. santarosae* keys in Ahmad and Burke (1972) to the section containing *A. grandis*, *A. fulvus* LeConte, *A. texanus* Dietz and *Lonocophorus fusiformis* Champion. It closely resembles the larvae of these species indicating

that all are fairly closely related to each other. A possible sister-group relationship between *A. grandis* and the subgenus *Anthonomorphus* was recently indicated in studies by Clark and Burke (in press). Studies are underway to test these hypotheses of relationships with further comparisons of the adult and immature stages of *A. grandis* and the species of *Anthonomorphus*, *L. fusiformis* and other species of *Loncophorus*, and *A. santarosae*.

The larva of *A. santarosae* differs from those of *A. fulvus* and *A. texanus* by the lack of pigmentation on the pleural lobes and body tubercles. The hosts of the latter two North American species also differ; larvae of *A. fulvus* develop in flower buds of *Callirhoe* and *Sphaeralcea* spp., while larvae of *A. texanus* develop in buds of *Sphaeralcea* spp. (Burke et al., 1984). If the color of the head capsule is deemphasized as a character, *A. santarosae* would trace to the couplet containing *L. fusiformis* with which it agrees in having four glossal setae as opposed to two in *A. grandis*. The host of *L. fusiformis* is *Ceiba* sp. (Bombacaceae). The larva of *A. santarosae* has a pale amber head capsule as compared to the light yellowish brown one of *A. grandis*. In addition to having only two glossal setae, *A. grandis* differs from *A. santarosae* in its host plants, not being known to develop in *Bombacopsis*.

The pupa of *A. santarosae* supports relationships determined by adult and larval characters. It is distinguished from pupae of *A. fulvus*, *A. texanus*, *A. grandis* and *L. fusiformis* by having three instead of five pairs of discotergal setae. There is occasionally an extra tubercle without a seta in the discotergal series, indicating that the three discotergal setae condition of *A. santarosae* represents a reduction from a basic four or five pairs of setae.

The assignment of this species to the genus *Anthonomus* was made only after consideration of its relationships with the species assigned to *Loncophorus* and *Atractomerus*. Champion (1903) characterized the species of *Loncophorus* [including species later transferred to *Atractomerus* by Voss (1944)] as "mostly of large size and navicular form," and Pierce (1916: 467) used presence of postocular lobes on the prothorax to distinguish his *Loncophorini* (including only the genus *Loncophorus*) from *Anthonomini*. Since the new species is not "navicular" in form and does not have postocular lobes it is provisionally placed in *Anthonomus*. Relationships of *A. santarosae* and the species now in *Loncophorus* and *Atractomerus* will receive further consideration in ongoing studies.

D. H. Janzen writes that "the host flower buds are aborted from the crowns of large trees (up to 30 m high) and land on the litter below. They are 1.5–3.0 cm long at this time and quickly dry into a hard case, with the larva feeding inside. Bud fall is in February, the first half of the 5 to 6-month dry season. The host tree is leafless. There is no hint of a second generation after the adults eclose. Ecdysis is through a hole cut in the side of the bud in late February and early March. The beetle is normally only one per bud, and at least three species of hymenopterous parasitoids have been removed from [*A. santarosae*] larvae. They eclose as adults through the side of the flower bud well after it has fallen from the tree."

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